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Abstract : Dans le cadre du développement des bioprocédés à biofilm de microalgues, nous nous sommes intéressés à mieux comprendre l'impact de divers facteurs biotiques (type de microalgue) et abiotiques (conditions hydrodynamiques) sur la structure des biofilms photosynthétiques. Cette première étape est en effet indispensable pour améliorer la productivité et la stabilité de ce type de bioprocédé. Pour ce faire, nous avons suivi la dynamique de la formation du biofilm de plusieurs espèces de microalgues cultivées dans différentes conditions à l'aide de la microscopie confocale et des outils d'analyse d'image.

Microalgae biofilms have been proposed as an efficient alternative to suspended cultures [1]. They offer enhanced productivities and straightforward harvesting by simple scrapping. However, little is known about their structure (spatial arrangement of cells, colonies and Extracellular PolymerS; EPS), which may strongly impact bioprocess stability and productivity. For example, nutrient diffusion may decrease as a function of the cell density or colonies size and light is attenuated and may become limiting for the deeper cell layers in very thick biofilms [2]. In order to better understand the structure development in microalgae biofilms, several microalgae strains were cultivated under static and dynamic conditions (the latter to simulate conditions closer to reality) and their architecture characterized in situ using confocal laser scanning microscopy.

Under static conditions, the general trend of the structural parameters resembled that described for fungi and bacteria: thickness and biomass increased over time whereas the roughness of the biofilm decreased reflecting cell proliferation and voids filling, respectively. However great variability of these parameters was observed among the species suggesting species-specific architectures. The same was true for the EPS that remained constant in some species and increased over time in others. When cultivated under different hydrodynamics, the biofilms grown under higher flow rate demonstrated greater resistance to detachment.

Our results revealed that the architecture of microalgae biofilms is species-specific and that growth conditions may alter their mechanical properties. This implies that the selection of the species and growth conditions are key steps to improve bioprocess stability and productivity.

Références :

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